



Homes Built on Slab Foundations Can Be Elevated, Too

Full Mitigation Best Practice Story

Harris County, Texas

Shoreacres, TX Retrofitting a home to elevate it above the base flood elevation (BFE) level is one of the most common approaches homeowners take to help protect their homes against flooding. But there's a widely held false belief that homes with slab foundations cannot be elevated. While it may be more costly to elevate a home built on a slab foundation compared to one built on pier-and-beam foundation, with the costs varying depending upon the method used, it may prove worth the investment in the event flooding occurs.



A Texas couple whose home had a slab foundation decided to elevate their house after Hurricane Ike (2008) caused a storm surge that flooded their home. Peter and Jessica McCloud of Shoreacres, a city located on Galveston Bay, took the unusual step of elevating their home themselves.

Hurricane Ike's storm surge caused flooding a mile and a half inland in Shoreacres, resulting in widespread damage from floodwaters that reached up to 17 feet. The McClouds' 2,600-square-foot home, which the couple bought three years before Hurricane Ike hit and was near completion of being remodeled, received two feet of water in the storm surge. But the couple never thought of moving away from their home, even though city codes mandated that the home be elevated if it were to be repaired.

Peter is an engineer and so is his father, and they were aided in the project with family friends who were also engineers. So the McClouds had available to them engineering expertise not normally available in a do-it-yourself home project.

"I have a reputation for doing things on my own," said Peter of the couple's decision to elevate their home themselves rather than using a contractor. "We had received quotes from contractors, who were supposed to get back to us regarding the work and the engineer's structural drawings. After a month, they still had nothing. Finally, we told them we'd pay for the engineer's drawings, but we were going to do it ourselves."

Jessica added, "When we decided to do it on our own, it was a weight off our minds."

In doing any type of home elevation, it's important to obtain necessary permits and follow local building codes, and the couple was careful to do that.

To repair and elevate their home, Peter and Jessica were able to use funds received from their flood insurance policy with the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP). Most standard NFIP policies include coverage called Increased Cost of Compliance (ICC) that provide up to an additional \$30,000 for hazard mitigation, money the couple used for elevating their home. In addition, they received a low-interest disaster loan from the U.S. Small Business Administration.

Along with Peter's father, who is a structural engineer, and a few engineering friends, everyone worked to finalize the elevation plans. The McClouds' method to elevate their home was to separate the frame from the slab. This allowed elevation of the frame only. To accomplish this, Peter used a bracing system of 2x4s attached to the frame two feet above the slab. He placed these at critical areas throughout the house, such as the corners, doorways and windows.

The first step once the work got under way was to remove the bricks and drywall from the outside of the house. "We pretty much said to everyone, 'Here's the wall, and here's your sledgehammer and wheelbarrow,'" said Jessica. It took two workdays to remove all the brick from the house.

After the bricks were removed, Peter disconnected the electrical wiring and, with the help of his father and engineering friends, placed the bracing system on the frame. Afterward, they removed the bolts connecting the frame to the slab. The final step was to actually raise the home.

A mathematical formula had been used to determine the number of jacks needed to lift the 70-ton house. The equation showed that 15 jacks were needed, but the McClouds decided to go well above that. To lift the house, 75 five-ton screw jacks were placed under the braces.

The next workday was an exciting one. "With 15 people and 75 jacks, we raised the house one foot in one day," said Peter. "We were definitely safe using 75 jacks because then the weight wasn't so heavy to lift in any one area. Also the jacks were oiled and moved easily."

"When people came to volunteer, we gave them their turning bar," said Jessica, "We told them to do three turns on a jack and make one pencil mark on the board by the jack to keep count." Peter explained that with three full turns of the jack the house was raised by a quarter of an inch. With this simple process they were able to systematically raise the house while keeping it level. As the workers raised the home, Peter and his father kept a constant watch to make sure it remained level as it was raised.

"When the volunteers first started turning the jacks, it was great because after three turns we could see daylight," said Peter. Everyone was excited to see they had actually raised the house themselves.

Within a few weeks, the McClouds had elevated the home the required four feet. The plans called for cement block columns and a cement block chain-wall to support the structure. Temporary blocks were put in place until a professional mason could complete the project.

Peter and Jessica followed the hazard mitigation concept of a continuous load path in their design plans. This calls for a continued line of connecting strength to all parts of the structure. It starts with rebar below ground. The rebar is fastened to the blocks above ground, which are strapped by metal braces to the frame of the house. The final support is completed with hurricane straps that attach the frame to the roof. This continuous load path, as well as replacing their 1950s windows with impact resistant glass, will help provide strength for their home to withstand enormous wind and water pressure from storms.

The remodeling and elevation of the McClouds' home is planned for completion by the one-year anniversary of Hurricane Ike's landfall in Texas, September 13, 2009.

Note: Although this couple elevated their home themselves, FEMA recommends that home elevations be undertaken in consultation with experts that include local building code authorities, engineers, and contractors.

Activity/Project Location

Geographical Area: **Single County in a State**

FEMA Region: **Region VI**

State: **Texas**

County: **Harris County**

Key Activity/Project Information

Sector: **Private**

Hazard Type: **Flooding**

Activity/Project Type: **Elevation, Structural**

Structure Type: **Masonry, Reinforced**

Activity/Project Start Date: **11/2008**

Activity/Project End Date: **Ongoing**

Funding Source: **National Flood Insurance Program (NFIP)**

Funding Recipient: **Property Owner - Residential**

Activity/Project Economic Analysis

Cost: **Amount Not Available**

Activity/Project Disaster Information

Mitigation Resulted From Federal
Disaster? **Yes**

Federal Disaster #: **1791 , 09/13/2008**

Federal Disaster Year: **2008**

Value Tested By Disaster? **No**

Repetitive Loss Property? **Unknown**

Reference URLs

No URLs were submitted

Main Points

No Main Points were entered.